

Package ‘kwb.hantush’

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Title Calculation of Groundwater Mounding Beneath an Infiltration Basin

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Description Calculation groundwater mounding beneath an infiltration basin based on the Hantush (1967) equation (<http://doi.org/10.1029/WR003i001p00227>). The correct implementation is shown with a verification example based on a USGS report (page 25, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>).

Depends R (>= 3.0.0), lattice

Imports hydroGOF

License GPL-2

LazyLoad yes

URL <http://kwb-r.github.io/kwb.hantush/>

BugReports <https://github.com/KWB-R/kwb.hantush/issues>

NeedsCompilation no

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baseProperties	<i>Hantush equation base properties</i>
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Description

Hantush equation base properties

Usage

```
baseProperties(time = 10, basinWidth = 10, basinLength = 10,
infiltrationRate = 0.5, horizConductivity = 10, iniHead = 10,
specificYield = 0.2, numberTimeSteps = 150)
```

Arguments

time	time elapsed since recharge began (T), (Default: 1.5 days)
basinWidth	half width of the recharge basin (L), (Default: 10 m)
basinLength	half length of the recharge basin (L), (Default: 10 m)
infiltrationRate	recharge (infiltration) rate (L/T), (Default: 0.5 m/d)
horizConductivity	horizontal hydraulic conductivity (L/T), (Default: 10 m/d)
iniHead	initial head (height of the water table above the base of the aquifer);(L), (Default: 10)
specificYield	specific yield (Default: 0.2)
numberTimeSteps	number of time steps to be used for average aquifer thickness calculation (Default: 150)

Value

Base properties for Hantush equation

References

p.22, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>

baseProps_ex1	<i>USGS verification example: base parameterisation</i>
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Description

USGS verification example

Usage

```
baseProps_ex1()
```

References

p.23, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>

compareModelResults	<i>USGS verification example: compare R results for water level increase with other models and calculate statistical goodness of fit values (e.g. RMSE, PBIAS, NSE)</i>
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Description

USGS verification example: compare R results for water level increase with other models and calculate statistical goodness of fit values (e.g. RMSE, PBIAS, NSE)

Usage

```
compareModelResults(conf = confDistances_ex1())
```

Arguments

conf list as retrieved by confDistances_ex1()

Value

data.frame with R results and other model including all goodness of fit criteria calculated with gof() of package hydrogof

References

Table 5, p.25, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>

See Also

[confDistances_ex1](#) for the USGS example parameterisation with distances

confDistances_ex1 *USGS verification example: model parameterisation (multiple distances)*

Description

USGS verification example: model parameterisation (multiple distances)

Usage

```
confDistances_ex1(x = c(0, 0.3, 3.3, 6.6, 10, 20, 25, 30, 40, 50, 75, 100,
  150, 200), config = conf_ex1, dbg = FALSE)
```

Arguments

x	vector of distances from the center of the recharge basin in the x direction (L) (Default: 0 feet)
config	name of configuration function (Default: conf_ex1)
dbg	If True additional messages on debug messages
...	further arguments passed to function "config"

References

p.23, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>

Examples

```
res <- confDistances_ex1()
if(FALSE){
#### Head for each time step (defined with parameter "numberTimeSteps")
xyplot(head ~ x | as.factor(sprintf("%f days", timeSteps)),
  data=res$timeSteps,
  type="b",
  las=1,
  as.table=TRUE)
#### Head at end of simulation
plot(head ~ x,
  data=res$simTime,
  type="b",
  las=1)
}
#### Water level increase at end of simulation & compare to alternative models
modelComparison <- compareModelResults(conf = res)
plotModelComparison(modelComparison = modelComparison)
```

conf_ex1 *USGS verification example: model parameterisation (one distance)*

Description

USGS verification example: model parameterisation (one distance)

Usage

```
conf_ex1(x = 0, y = 0, baseProps = baseProps_ex1(), dbg = FALSE)
```

Arguments

x	distance from the center of the recharge basin in the x direction (L) (Default: 0 feet)
y	distance from the center of the recharge basin in the y direction (L) (Default: 0 feet)
baseProps	basic model properties as retrieved by baseProps_ex1()
dbg	If True additional messages on debug messages

References

p.23, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>

See Also

[baseProps_ex1](#) for the USGS example parameterisation

erf *Error function*

Description

Error function

Usage

```
erf(x)
```

Arguments

x	x
---	---

Value

Error function result

References

<https://stat.ethz.ch/R-manual/R-devel/library/stats/html/Normal.html>

getModelComparisonTable

USGS verification example: get model comparison table

Description

USGS verification example: get model comparison table

Usage

```
getModelComparisonTable()
```

Value

data.frame with water level increase of different model approaches

References

Table 5, p.25, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>

Examples

```
modelComparison <- getModelComparisonTable()
```

hantush

Hantush equation

Description

Hantush equation

Usage

```
hantush(x = 0, y = 0, baseProps = baseProperties(), dbg = TRUE)
```

Arguments

x	distance from the center of the recharge basin in the x direction (L)
y	distance from the center of the recharge basin in the y direction (L)
baseProps	basic model properties as retrieved by baseProperties()
dbg	If True additional messages on integration quality of function hantushSstar are printed on screen

Value

Head at a given time after recharge begins

References

p.22, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>

See Also

[baseProperties](#) for basic model properties

`hantushDistances` *Hantush distance: for for multiple coordinate*

Description

Hantush distance: for for multiple coordinate

Usage

```
hantushDistances(x = 0:10, y = rep(0, length(x)), config = hantush,  
  dbg = TRUE)
```

Arguments

- `x` vector with distances from the center of the recharge basin in the x direction (L), (Default: each meter between 0-100m)
- `y` vector with distances from the center of the recharge basin in the y direction (L), (Default: 0 times length of x)
- `config` function as retrieved by `hantush()`
- `dbg` If True additional debug messages are printed on screen

Value

Head at a given time after recharge begins

See Also

[hantush](#) for parameterising the Hantush equation

hantushDistancesBaseProps

Hantush distances & base properties: allows input of vector of x,y coordinates and also a vector for one of the base properties

Description

Hantush distances & base properties: allows input of vector of x,y coordinates and also a vector for one of the base properties

Usage

```
hantushDistancesBaseProps(x = seq(0, 200, 5), y = rep(0, length(x)),
  baseProps = baseProperties(time = 2^(0:6), infiltrationRate = 1, basinWidth
    = 10, basinLength = 50, horizConductivity = 10, iniHead = 10, specificYield =
    0.2), dbg = FALSE)
```

Arguments

x	vector with distances from the center of the recharge basin in the x direction (L), (Default: every 5 meter between 0-200m)
y	vector with distances from the center of the recharge basin in the y direction (L), (Default: 0 times length of x)
baseProps	as retrieved by baseProperties(), but one property is allowed to be a vector (e.g. infiltrationRate = c(1,2,4))
dbg	If True additional debug messages are printed on screen

Value

List with sublists "dat" (x,y,head & WLincrease), "changedBaseProp.Name" (name of base property with multiple values) and "baseProps" (complete base parameterisation)

See Also

[baseProperties](#) for basic model properties

Examples

```
baseProps <- baseProperties( time = 2^(0:6),
  infiltrationRate = 1,
  basinWidth = 10,
  basinLength = 50,
  horizConductivity = 10,
  iniHead = 10,
  specificYield = 0.2,
  numberTimeSteps = 15)
res <- hantushDistancesBaseProps(baseProps = baseProps)
```



```

cols <- length(unique(res$dat[[res$changedBaseProp.Name]]))
mainTxt <- sprintf("Changed baseProperty: %s", res$changedBaseProp.Name)
xyplot(WLincrease ~ x,
       groups=res$dat[[res$changedBaseProp.Name]],
       data=res$dat,
       type="b",
       auto.key=list(columns=cols),
       main=mainTxt)

```

hantushS

Helper function hantushS

Description

Helper function hantushS

Usage

hantushS(x, alpha, beta)

Arguments

x	distance between 0 and half length of recharge basin
alpha	alpha
beta	beta

Value

Hantush star

References

p.22, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>

hantushSstar

Hantush function Sstar

Description

Hantush function Sstar

Usage

hantushSstar(alpha, beta, dbg)

Arguments

alpha	alpha
beta	beta
dbg	If True additional messages on integration quality of function hantushSstar are printed on screen

Value

Hantush Sstar result

References

p.22, <http://pubs.usgs.gov/sir/2010/5102/support/sir2010-5102.pdf>

plotModelComparison *USGS verification example: plot model comparison results*

Description

USGS verification example: plot model comparison results

Usage

```
plotModelComparison(modelComparison = compareModelResults(), title = "",
  ...)
```

Arguments

modelComparison	data.frame as retrieved by compareModelResults(), Default: (compareModelResults())
title	to be used as title above plot (Default: "")
...	further arguments passed to function xyplot()

Value

model comparison goplots

See Also

[compareModelResults](#) for comparison with USGS benchmark models

Examples

```
### Plot model comparison with title "Model comparison" and one plot for
### each page
plotModelComparison(title = "Model comparison",
  layout = c(1,1))
```

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